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ABSTRACT

Currently, there is concern about the quality of Navy training. This concern is best exemplified by the present debate over the adequacy of "self-pacing" in Navy training courses. This paper illuminates some perceptions surrounding self-pacing in Navy training, explores some realities of Navy training, and presents a recommendation about how best to proceed. The paper offers the following conclusions: (1) self-pacing is misunderstood; (2) self-pacing is not the only factor responsible for perceived declines in the quality of Navy training, and may not be involved at all; (3) Navy training courses have more serious problems than their method of delivery; (4) traditional delivery methods will not guarantee instructional quality; (5) all forms of delivery, including self-pacing, have advantages and disadvantages that involve complicated trade-offs; and (6) there are no simple solutions to the problems of Navy training. Guidance from the Chief of Naval Education and Training (CNET) concerning how to proceed is well founded. Any attempt to effect major changes in existing instructional systems without the controlled test and evaluation called for by CNET would be both reckless and costly. Specifically, changing a course from lock-step to self-paced or from self-paced to lock-step without sufficient evidence that the quality of the instruction will improve and/or significant cost savings will occur would be counter to CNET's guidance. (Author/KC)

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Self-Paced Training: Perceptions and Realities

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ABSTRACT

There is current concern about the quality of Navy training. This is best exemplified by the current debate over the adequacy of "self-pacing" in Navy training courses. Navy training programs suffer from a variety of problems, and these contribute to uncertainty about how to manage various training situations. All of these problems and uncertainties interact. To blame declines in the quality of Navy training on any single factor, such as "self-pacing," would be an oversimplification. This paper illuminates some "perceptions" surrounding self-pacing in Navy training, explores some "realities" of Navy training, and presents a recommendation about how best to proceed. The paper concludes that:

1. Self-pacing is misunderstood.
2. Self-pacing is not the only factor responsible for perceived declines in the quality of Navy training, and may not be involved at all.
3. Navy training courses have more serious problems than their method of delivery.
4. Traditional delivery methods will not guarantee instructional quality.
5. All forms of delivery, including self-pacing, have advantages and disadvantages that involve complicated trade-offs.
6. There are no simple solutions to the problems of Navy training.

Recent guidance from the Chief of Naval Education and Training concerning how to proceed is well conceived. Any attempt to effect major changes in existing instructional systems without the controlled test and evaluation called for by CNET would be both reckless and costly. Specifically, changing a course from lock step to self-paced or from self-paced to lock step without sufficient evidence that the quality of the instruction will improve and/or significant cost savings will occur would be counter to CNET's reasoned guidance.

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EXECUTIVE SUMMARY

There is current concern about the quality of Navy training. This is best exemplified by the current debate over the adequacy of "self-pacing" in Navy training courses. Navy training programs suffer from a variety of problems, and these contribute to uncertainty about how to manage various training situations. All of these problems and uncertainties interact. To blame declines in the quality of Navy training on any single factor, such as "self-pacing," would be an oversimplification. This paper explores the following "perceptions" and "realities" surrounding self-pacing in Navy training.

PERCEPTION: Self-pacing is an optimal method for delivering instruction, and should be used as widely as possible in Navy training.

REALITY: When a careful requirements analysis has indicated that self-pacing is appropriate for meeting a particular training need, then self-pacing should be recommended. The same is true for any other method of delivery, including traditional "lockstep" instruction. The trade-offs are complex; they often involve achieving cost avoidances or management or scheduling efficiencies at the cost of some unknown effect on student learning.

PERCEPTION: Individualized Instruction is the same thing as self-paced instruction.

REALITY: Self-pacing is only one form of individualization, and may not always be the best method. Instruction may be given on an individual basis, but be paced by an instructor or a computer. Even in "group-paced" classrooms, instruction might be given in different ways to different students.

PERCEPTION: In self-paced courses students manipulate the system to stay in school longer.

REALITY: This may be true for a few students, however, all the research studies that have compared lockstep and self-paced instruction have shown that students generally complete self-paced courses 15% to 20% faster than they do comparable lockstep courses (Orlansky & String, 1979).

PERCEPTION: Self-paced instruction is of poor quality.

REALITY: Research has shown that when individualized courses are compared with traditional "lock-step" courses, they save considerable time with students achieving the same or slightly better school performance. For example, in comparisons done in 48 military training courses, achievement in individualized courses was equal to that of conventional courses in 32 cases, superior in 15 cases, and slightly poorer in only one case (Orlansky & String, 1979).

The general rule is that when self-pacing is used to deliver poor training materials,or when self-pacing is implemented poorly, then poor training results. The same is true of any other method of delivery.

PERCEPTION: Self-pacing is responsible for the poor quality of graduates from such courses as Propulsion Engineering, Radioman "A", Basic Electricity/Electronics (BE/E).

REALITY: Self-pacing has been blamed for the poor quality of several Navy training courses. In nearly all of these, the real culprit is not self-pacing, but some other combination of factors such as poor training materials, sloppy implementation of the training program, or failure to prepare instructors to manage student learning. It is unlikely that changing only the method of delivery of any current course will result in significant improvement.

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PERCEPTION: Self-pacing eliminates the need for instructors.

REALITY: One may find examples of very bright and highly motivated Navy students performing well without an instructor, but this is certainly not a generalizable rule. Instructors should play an important role in "self-paced" instruction, and actually should pace it themselves.

PERCEPTION: Graduates of self-paced courses don't know "theory."

REALITY: Graduates of most Navy courses, not just self-paced ones, don't know theory. The reason is not that some courses are self-paced, but instead, that the courses themselves do not teach the theory. The reasons for this state of affairs have nothing to do with self-pacing.

PERCEPTION: ISD always results in a self-paced course.

REALITY: Self-pacing is not required in ISD. The ISD process is a means for defining training goals, deciding upon the best means of achieving them within resource constraints, and providing evaluation of the program. Any method of presentation (traditional, individualized, self-paced, or computer-managed) can be chosen.

PERCEPTION: Traditional lockstep instructional delivery results in better learning and performance.

REALITY: Traditional delivery is no guarantee of instructional quality or training efficiency.

PERCEPTION: A poor-quality self-paced course can be resurrected simply by converting it to "lockstep" delivery.

REALITY: Because (a) problems with self-paced Navy courses are due to other factors than self-pacing per se, and (b) traditional delivery does not always result in quality, wholesale conversion of self-paced courses to traditional delivery is not likely to improve those courses. If no curriculum revisions are made, then conversion will most probably result in a further decrement in quality while the courses are perturbed.

Conclusions

1. Self-pacing is misunderstood.
2. Self-pacing is not the only factor responsible for perceived declines in the quality of Navy training, and may not be involved at all.
3. Navy training courses have more serious problems than their method of delivery.
4. Traditional delivery methods will not guarantee instructional quality.
5. All forms of delivery, including self-pacing, have advantages and disadvantages that involve complicated trade-offs.
6. There are no simple solutions to the problems of Navy training.

Recommendation

Recent guidance from the Chief of Naval Education and Training concerning how to proceed is well conceived. Any attempt to effect major changes in existing instructional systems without the controlled test and evaluation called for by CNET would be both reckless and costly. Specifically, changing a course from lock step to self-paced or from self-paced to lock

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step without sufficient evidence that the quality of the instruction will improve and/or significant cost savings will occur would be counter to CNET's reasoned guidance.

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Self-Paced Training: Perceptions and Realities

Introduction

There is current concern about the quality of Navy training. This is best exemplified by the current debate over the adequacy of "self-pacing" in Navy training courses.

Navy training programs suffer from an inadequate "stable" of experts for training program design and development, poor analysis of how to match training to jobs, inadequate prescriptions for deciding how to train, inadequate performance measurements, differences in student skills and motivation, systemic problems in delivering training courses, a poor acquisition mechanism for contractor-developed training courses, no systematic maintenance system for curriculum quality, no effective system of quality control for Navy instruction, insufficient funding for careful course design and delivery, shortages of training equipment, shortages of experienced instructors, poor instructor training, and uncertainty about how to manage this situation.

There is a tendency to search for simplistic solutions to these problems. Some in the Navy feel that if we could only return to the traditional instructor-on-a-podium method of instruction then all would be well. But its not that simple. There have been significant changes in society over the past 20 years which have affected the state of Navy training. These include transition to the All-Volunteer Force with changes in the recruiting pool, changes in public education with differences in the skills and abilities recruits bring to the Navy, the "television generation," declining College-Board test scores; the list goes on and on. There have been changes in the way the Navy develops, delivers, and manages training. These changes occur at a time of radical technological change and growing complexity in the Navy and society in general.

All of these changes and conditions interact. To blame declines in the quality of Navy training on any single factor, such as "self-pacing," would be an oversimplification. It would be like blaming our failure in Viet Nam on having the draft instead of the all volunteer force. Yet, the inability of Navy electronics technicians to repair radios is being blamed on self-pacing in the BE/E course even though the course content is basically the same as it was before the course was self-paced, and even though several months of additional training are given between BE/E and fleet assignment.

The purpose of this paper is to illuminate some of the "perceptions" surrounding self-pacing in Navy training, to explore some of the "realities" of the current state of Navy training, and to present a recommendation about how best to proceed.

PERCEPTION: Self-pacing is an optimal method for delivering instruction, and should be used as widely as possible in Navy training.

REALITY: When a careful requirements analysis has indicated that self-pacing is appropriate for meeting a particular training need, then self-pacing should be recommended. The same is true for any other method of delivery, including traditional "lockstep" instruction.

For example, lockstep instruction is very well adapted to recruit training, apprentice training (SA, FA, AA), and training for sonar or CIC teams. In general, lockstep instruction is appropriate for training involving the development of team or unit skills.

Self-pacing is not a panacea, and educators have never claimed that it was. There are a variety of problems with self-pacing which sometimes limit its usefulness and which must be properly understood before a decision is made to implement it. These problems can include poor student motivation, poor student and instructor opinion, inability of students to manage their study,

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and scheduling complexity.

Educators generally advocate some form of individualized instruction, but not necessarily self-pacing. However, individualized training including self-pacing can provide several benefits in Navy schools. These benefits include the following:

1. Individualization can provide a reduction of 15% to 20% in time to complete a course (Orlansky & String, 1979).

2. Individualized courses can reduce the idle time that occurs when students complete one course in their training sequence and must wait for the convening of a following course, because courses can "convene continuously."

3. The continuous convening of an individualized course also provides greater access to schools. Convening dates of lock-step courses often fall at times when students are unavailable because of ship assignments or other job duties. Self-paced courses are available whenever a student can be spared.

4. A self-study approach appears particularly appropriate for maintenance-oriented courses, because these typically require a student to learn to use and interpret technical manuals and other job-aids. For these courses, the self-study is often more job-like than a conventional lecture, and should have greater probability of transfer to the actual job situation.

5. Individualized courses may be more easily transferred to remote-site use, assuming that any necessary laboratory equipment is available.

6. Individualized courses are in a sense available off-the-shelf. If greater throughput of a course is required, this can be accomplished without a concomitant increase in the number of experienced instructors required.

The point of all this is that there is no easy answer to the question of whether or not to self-pace or individualize a course. The trade-offs are complex; they often involve achieving cost avoidances or management or scheduling efficiencies at the cost of some unknown effect on student learning.

PERCEPTION: Individualized Instruction is the same thing as self-paced instruction.

REALITY: Self-pacing is not always the best method of individualization. Instruction may be given on an individual basis, but be paced by an instructor or a computer. For example, in pilot training, instruction is often highly individualized. But, it is not paced by the student, but rather by an experienced instructor. Likewise, modern computer-based instructional programs usually require the student to interact heavily with the material to be learned, and the computer program determines the rate and flow of the instruction. Even in "group-paced" classrooms, instruction might be given in different ways to different students.

Research on "learner control of instruction" generally shows that students are not good at determining what, how, or how fast to study. This leads to the conclusion that self-pacing may not be the best method of individualization.

Research also tends to show that more mature learners can handle self-paced instruction better than novices or recruits. For this reason, self-pacing is often effective in advanced Navy "C" and "F" schools or in certain Officer training programs, even though it may not work in large preparatory or "A" schools.

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PERCEPTION: In self-paced courses, students "manipulate the system" to stay in school longer.

REALITY: This may be true for a few students, however, research studies that have compared lockstep and self-paced instruction have shown that students complete self-paced courses 15% to 20% faster than they do comparable lockstep courses (Orlansky & String, 1979). If students are manipulating the system they are doing a poor job of it.

PERCEPTION: Self-paced instruction is of poor quality.

REALITY: Research has shown that when individualized courses are compared with traditional "lock-step" courses, they save considerable time with students achieving the same or slightly better school performance. For example, in comparisons done in 48 military training courses, achievement in individualized courses was equal to that of conventional courses in 32 cases, superior in 15 cases, and slightly poorer in only one case (Orlansky & String, 1979).

The general rule is that when self-pacing is used to deliver poor training materials,or when self-pacing is implemented poorly, then poor training results. The same is true of any other method of delivery.

PERCEPTION: Self-pacing is responsible for the poor quality of graduates from such courses as Propulsion Engineering, Radioman "A", Basic Electricity/Electronics (BE/E).

REALITY: Self-pacing has been blamed for the poor quality of several Navy training courses. In nearly all of these, the real culprit is not self-pacing, but some other combination of factors such as poor training materials, sloppy implementation of the training program, or failure to prepare instructors to manage student learning. In the next few paragraphs, the real situations surrounding some Navy courses are discussed.

Propulsion Engineering:

The Propulsion Engineering curriculum is a case in point. The original course was carefully designed. While it was individualized, it was designed for heavy instructor management, and was in fact managed by instructors through mid-1977. During that period, student achievement and instructor and student satisfaction with the course were good. Then, in 1977, a decision was made to shift test scoring and student progress management to the Navy's CMI (Computer-Managed Instruction) system.

At the time of this modification, the Commanding Officer of the PE School requested NPRDC to conduct an experimental comparison of the instructor-managed and computer-managed versions of the course. The study was begun in December 1976 and continued through January 1978. Results of the study were documented in a Letter Report to the Chief of Naval Technical Training in September, 1978. The study showed that (1) training time was longer for the existing form of CMI management, (2) comprehensive test performance was slightly lower for CMI students, and (3) module test performance was essentially equivalent for both computer and instructor management. However, interviews with CMI instructors and support personnel revealed a pervasive dissatisfaction with CMI. Instructors felt that they did not have enough interaction with individual students under CMI, and therefore were not aware of students' academic problems. They had more contact under instructor management because they individually scored each student's module tests. Results also indicated no differences in instructor-student

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ratios, but differences in instructors' time allocation.

Both versions of the course used the same course materials and tests; the only difference was in the method of management of the individualized course. The results indicate that the advantages of self-pacing can be obscured by the method used to manage student progress.

Radioman "A" School:

The Radioman "A" course has been a comedy of errors since it's revision began in 1977. The Navy chose this course as the first course to use new ISD development methods. Unfortunately, the ISD methods themselves had received no careful test for utility or adequacy. The ISD team was staffed with people who had little experience either with ISD or with the Radioman rate. The Fleet chose not to support the effort with an adequate supply of subject matter experts. The result was a poor course; it would have been poor regardless of the method of delivery.

Some evidence of the lack of quality comes from a recent effort by Stern and Fredericks (1982). They evaluated a module of the Radioman "A" course that had just been redone using ISD procedures. The lessons were to train people how to verify the correctness of messages typed on a form to be read by an optical character reader. Students were having problems learning from the lessons and instructors suggested that they needed revision. The main constituents of instruction, i.e., objectives, tests and learning materials, were found to be flawed even after revision according to ISD procedures. Some objectives were not related closely to the performance or knowledge required by the job. Testing did not always measure the performance or knowledge as specified in the objectives. Instruction was often not geared to the objectives or to the tests, and, as a result, was often confusing and otherwise inadequate.

The conclusion from this study and other analyses of the adequacy of Radioman course materials is that poor instructional design and development is responsible for inadequate student performance, not the course's method of delivery.

Basic Electricity and Electronics:

The Basic Electricity and Electronics (BE/E) course was never designed carefully from its inception. Through the 1950s and 60s, Navy electronics training was both extensive and theory and math intensive. Well qualified trainees were amply available, thanks in part to the draft. "A" School electronics courses, often eight months long, challenged the trainees and also prepared them for the rigors of the "B" schools. "B" schools of up to fifteen months were available to qualified re-enlistees. These schools resembled university engineering programs.

Perhaps it was inevitable that two dozen or more schools around the country independently teaching the same content would generate pressure for consolidation. In the early 1960s, consolidations were carried out, and a common syllabus, based on Bureau of Personnel publications, was adopted at each of the major training centers.

Two factors which came into play in the 1960s and 70s resulted in major changes in Navy electronics training. First, the Programmed Instruction (PI) movement reached its peak of popularity in the 60s. Evaluation of this approach in the Navy was judged desirable, and a contractor (Westinghouse) was funded by the Bureau of Personnel to convert the basic or introductory portion of Electricity/Electronics courses into a self-teaching format. The contractor's charter was not to change the substance of the course, but rather

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to convert it into a different "delivery system." With the assistance of a committee of E/E instructors from San Diego schools, the basic lectures of the BuPers syllabus were converted into narrative and PI materials, summaries were written, test items were inserted as progress checks, and module tests, midterms, and final exams were also prepare from existing test items. The project was expected to be an experimental comparison of three different self-study formats, narrative, programmed instruction, and sound-slide. It appears that the project ran out of support: only a few locally produced sound-slide materials ever appeared. The comparative evaluation, if completed, was not published. Nevertheless, in 1968, a partially self-paced compromise version of several variations of instructor-taught basic E/E was offered.

Second, in 1967, NPRDC (then NPTRL) and CNATECHTRA began work on a computer-managed instruction (CMI) system. The course selected for this project was the Westinghouse conversion of the basic E/E course. With minor modifications, it was on-line at NAS Memphis as a CMI course in 1973. Again, however, the course was not systematically redesigned.

A major organizational change also influenced BE/E training. Following recommendations of the Cagle Board, control of technical training was moved from BuPers in 1972, and vested in two new organizations, CNET and CNTT, with the latter absorbing the functions of CNATECHTRA. These new organizations evaluated the CMI course and concluded that this form of training could be effective and economical. A CNTT in-house group (MIISA) was created to improve and expand the CMI software. Basic E/E was consolidated in four schools and incorporated into the CMI system. In 1975, the Westinghouse version of the San Diego compromise of the BuPers version of Basic E/E was standardized throughout the Navy. Since 1975, while there have been cosmetic changes to the course material, the only substantive modifications have been to increase the CMI system's ability to output various summary reports, to eliminate some "nice-to-know" material, and to add some modules on newer technologies such as transistors. The current self-study materias were recently edited to make them more consistent and readable. Fundamentally, however, BE/E today is the product of mandated time reductions, consolidations, and changes in management and delivery, all of which took place without course redevelopment.

Another organizational change, occurring early in the 1970s, was the elimination of the "B" schools. Also during the 70s there was increased reliance on specific equipment "C" schools, probably because of the accelerating acquisition of many new weapons systems.

In summary, the current Basic E/E course materials originated with WW II electronics training several technological generations ago. Today, we have a reasonable management system (CMI), a questionable delivery system (PI), and a subject matter which dates back to 1952 if not earlier, with which to conduct the initial conceptual training of all the electronics technicians needed in the 1980s. We have a course originally intended to provide 8 to 16 months of electronics instruction to very well-qualified students, which is now delivered to current recruits in about 30 days. Further, current instructors are graduates of this training, not the intensive training of a generation ago, and these instructors receive no special preparation for managing this peculiar course.

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In general, then, there is a curriculum problem, not a self-pacing problem in BE/E. No job or task analysis was ever performed; instead, materials on electronics were adopted from very old courses. There are known inadequacies in the course, including poor instructional design, and tests which can be answered without knowing the content, or answered correctly on the basis of incorrect knowledge. Students do not seem to develop a good conceptual understanding of electronics fundamentals in the short time available. It is likely that repair of this course will require lengthening it, with greater concentration on the conceptual foundations of electronics. It is unlikely that changing only the method of delivery of the current course will result in any significant improvement.

PERCEPTION: Self-pacing eliminates the need for instructors.

REALITY: One may find examples of very bright and highly motivated Navy students performing well without an instructor, but this is certainly not a generalizable rule. Instructors should play an important role in "self-paced" instruction, and actually should pace it themselves. They should closely monitor each student's progress, develop remedial materials, and give remediation to students who are having problems. Unfortunately, one of the problems with implementing self-pacing in the Navy has been the ill-defined role of the instructors. Often instructors in self-paced courses see themselves as little more than paper pushers. A good example of this is the PE course discussed earlier. When the course was instructor managed, instructor morale was good and the instructors were very involved with their students. When the computer took over scoring the tests and providing remediation instructor morale dropped. The amount of time they spent interacting with students also dropped. This could have been avoided by by better defining the instructor's role in the CMI environment.

PERCEPTION: Graduates of self-paced courses don't know "theory."

REALITY: Graduates of most Navy courses, not just self-paced ones, don't know theory. The reason is not that some courses are self-paced, but instead, that the courses themselves do not teach the theory. NPRDC is currently engaged in analyzing the curricula for a variety of Navy courses to determine how often various types of learning requirements occur. For each course, each individual learning objective is being categorized according to the type of information it requires the student to learn. The findings so far are as follows: A total of 9,208 objectives in 98 different courses (21 'A' and 77 'C' or 'F' schools) have been examined. (Only a few of these courses are self-paced.) These objectives are taught to an annual throughput of almost 63,000 students. Of these 9,208 objectives, only 584 or 6.3% require knowledge of theory. The rest require knowledge of equipment terminology, part names, controls, etc., or knowledge or performance of procedural actions such as calculations, equipment start-up or shut-down, or preventive maintenance.

The reasons for this state of affairs are not simple, and have nothing to do with self-pacing. Instead, they have to do with shortfalls in funding for training, requirements to eliminate "nice-to-know" information, and the inability of typical Navy or contractor instructional developers to analyze training requirements to identify needed theory.

PERCEPTION: ISD always results in a self-paced course.

REALITY: Self-pacing is not required in ISD. ISD evolved not as a specific method of teaching, but as a way to determine what trainees really need to know and to insure that they learn it. With reference to training, ISD has two major goals: to make training (1) job-relevant (meaning it would ultimately prepare the trainee for his or her function(s) in Navy readiness), and (2) cost-effective and efficient (meaning it would use the most efficient training methods to do the training). With regard to the management of the development of instructional programs, ISD has the goal of making the process more efficient and less haphazard and providing a basis for controlling and evaluating changes.

It is important to understand these training and management goals because people have often confused ISD with particular teaching techniques. The ISD process is a means for defining training goals, deciding upon the best means of achieving them within resource constraints, and providing evaluation of the program. In theory, any method of presentation (traditional, individualized, self-paced, or computer-managed) could be chosen, depending upon its feasibility. In practice, the preferred method is often some form of individualization, because it has been shown to be more efficient since it takes advantage of the fact that people learn at different rates (Branson, Rayner, Cox, Furman, King, & Harnum, 1975). There are a number of questions-- which research can help answer--about how to implement various types of individualized instruction and whether they are effective for all trainees.

PERCEPTION: Traditional lockstep instructional delivery results in better learning and performance.

REALITY: Even with the advent of ISD developing and delivering instructional programs depend very heavily on the expertise of the people doing the development and delivery. Instructional design is still to some degree an intuitive process. Self-paced instruction which is carefully developed solves this problem in part by standardizing the instruction. That is, all students receive the same content. (Of course if the content is bad then a problem still exists). With the traditional approach the content is often left up to the individual instructor. The problem with this is that the intuitions of instructors about what and how to teach can vary widely. The resulting instruction may then teach irrelevant things, or perhaps leave out things very important to people's job performance. Thus, instability or variability often occurs in the traditional instructional process.

The problems that can occur with traditional instruction are illustrated by a recent NPRDC project (Van Kekerix, Wulfeck & Montague, 1982). An existing, fairly typical, Navy C school was converted to self-study. As part of that project data was collected on the efficiency and quality of the traditional course before any intervention.

NPRDC personnel attended two cycles of the course, and recorded student engaged time and other observable behaviors found to be significantly related to the acquisition and retention of learning (Lienhardt, 1977; Cooley & Lienhardt, 1978; Stalling 1973; Cooley & Lohnes, 1976; Berliner & Rosenshine, 1977; Dunkin, 1978; Slavin, 1980; McKenzie & Henry, 1979; Evertson & Veidman, 1981). Seven students were enrolled in the course during these two cycles, three in one, and four in the other. The data collected included measures of student time spent in lectures, laboratory exercises, performance tests, breaks, and in the laboratory but not actually performing an exercise. (Only one system was available in the laboratory, so students often had to wait for others to complete their lab assignment or performance test.) Student

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administrative duties, such as visits to the personnel office, were not included as breaks, but were included in total days enrolled in the course.

In general, the data indicate that the original course was inefficient. First, instructors were able to deliver instructional content for less than half the allotted time. Second, the group-pacing of the course led to inefficient use of training equipment. This occurred because only two students could work on a laboratory problem while their classmates had to wait. Therefore, laboratory equipment was under-utilized during lectures, while queuing resulted during laboratory performance periods. Third students did not spend much of their available time on-task.

The two Instructor/Subject Matter Experts assigned to the course attended an Instructional Quality Inventory (IQI) Workshop to learn IQI analytic techniques. (The IQI is described in Wulfeck, Ellis, Richards, Wood, & Merrill, 1978.) They then performed two IQI analyses of the course materials: (1) the course learning and enabling objectives were classified into Task/Content categories, and (2) the various instructional materials were rated on the basis of adequacy of their coverage of the learning specified in the objectives. The analyses identified the following deficiencies:

1. The objectives over-emphasized remembering information.
2. No written test materials were available.
3. Many more study questions were needed.
4. The instructional materials covering use of the Technical Manual were incomplete, and provided no practice in using the special features of that manual.

The point of all this is that traditional delivery is no guarantee of instructional quality or training efficiency.

PERCEPTION: A poor-quality self-paced course can be resurrected simply by converting it to "lockstep" delivery.

REALITY: It should be clear that because (a) problems with self-paced Navy courses are due to other factors than self-pacing per se, and (b) traditional delivery does not always result in quality, that wholesale conversion of self-paced courses to traditional delivery is not likely to improve those courses. If no curriculum revisions are made, then conversion will most probably result in a further decrement in quality while the courses are perturbed.

Conclusion

In this paper, we have tried to make the following points.

1. Self-pacing is misunderstood.
2. Self-pacing is not the only factor responsible for perceived declines in the quality of Navy training, and may not be involved at all.
3. Navy training courses have more serious problems than their method of delivery. In fact, how a course is taught is quite a way down on the list of design and development concerns. The most important issues are, (1) is the right knowledge/skill being taught, (2) is the quality of the instruction and test items sufficient, and (3) are the objectives, test items and instruction all consistent with one another. How the instruction is presented is not as serious a concern and is often decided economically rather than pedagogically.

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4. Traditional delivery methods will not guarantee instructional quality.
5. All forms of delivery, including self-pacing, have advantages and disadvantages that involve complicated trade-offs.
6. There are no simple solutions to the problems of Navy training.

In conclusion, it is time to recognize that training systems are no less complex than modern weapons systems. Like hardware systems, training systems require the same careful research, development, test, and evaluation during their initiation, and the same kind of attention to preventive and corrective maintenance and life-cycle support.

Recommendation

The Chief of Naval Education and Training in a letter to all Commanding Officers in the Naval Education and Training Command said:

> "We all must step back and take a close look at what is going on in our classrooms. It is not enough to know whether it is lockstep, self-paced, CMI or one-on-one laboratory instruction. We need to assure ourselves that the teaching and learning going on at the classroom level is of the quality required to produce well-trained sailors. If it isn't, then we all need to work together to make it so."

He further stated:

> "I am confident that promising techniques and new technologies do have a major role to play in support of instruction. But there must be more controlled test and evaluation which spells out accompanying training requirements and which develops specific documentation showing that cost and learning effectiveness standards have been met."

This guidance for how to proceed is well reasoned. Any attempt to effect major changes in existing instructional systems without the controlled test and evaluation called for by CNET would be both reckless and costly. Specifically, changing a course from lockstep to self-paced or vice versa without sufficient evidence that the quality of the instruction will improve and/or significant cost savings will occur would be counter to CNET's reasoned guidance.

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